

REMARKS

This amendment is responsive to the Office Action mailed December 29, 2004 in connection with the above-identified patent application. In that Action, various earlier objections and claim rejections were withdrawn. More particularly, the objection to the drawings under 37 C.F.R. § 1.83(a) was withdrawn. Further, the rejection of claims 1, 11-18, and 20-31 under 35 U.S.C. § 112, first and second paragraphs were withdrawn. The rejection of claim 1 as being anticipated by U.S. Patent No. 5,008,573 to Beppu, et al. was withdrawn. Similarly, the rejection of claims 1, 11, and 18 over (separately) U.S. Patent No. 5,365,388 to Maughan, et al. and JP 05-199,721 to Takahashi were withdrawn.

Of particular significance to the instant amendment, however, claim 20 was objected to as being of improper dependent form for failing to further limit the subject matter of a previous claim. Also, claims 1, 11, and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Takahashi (JP 05-199,721) and Schmider (US 5,006,765).

Lastly in the Office Action, claims 24-31 were indicated as being allowed and claims 12-17 and 21-23 were objected to as being dependent upon a rejected base claim, but were indicated as being allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

THE NON-ART REJECTIONS

Claim 20:

As noted above, claim 20 was objected to Under 37 C.F.R. § 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. The Examiner took the position that claim 20 is improper because because it fails to further limit the parent claim having which already includes a limitation of a punched-out grid.

Applicant has canceled claim 20 from further consideration herein. In addition, applicant has tendered an amendment to dependent claim 21 to now depend from claim 17.

For at least the above reasons, applicant respectfully submits that claims 12-18 and 21-23 are now in proper form.

THE ART REJECTIONS

As noted above, claims 1, 11, and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable by the combination of Takahashi '721 with Schmider '765. The Examiner took the position that Takahashi teaches every aspect of the invention except the base plate including an extrusion-coated punched grid to dampen torque vibrations. According to the Examiner, Schmider teaches using an extrusion-coated punched-out grid to support a stator inside a rotor to provide a cost effective and reliable electrical connection to the motor. The Examiner concluded that it is inherent that an extrusion-coated punched-out grid of Schmider will reduce some of the high frequency torque vibrations of the motor because it would have been obvious to a person of ordinary skill in the art to construct the motor of Takahashi with the circuit board replaced by an extrusion-coated punched-out grid to provide a cost effective and reliable electrical connection to the motor.

The Present Application:

For purposes of review, the present application is directed to an electromotive motor for possible use with a pump of a power-assisted steering system in a motor vehicle. One advantage offered by the device of the application is that an electromotive drive for the pump is provided wherein disturbing noises caused by vibrations are reduced and/or prevented. Prior art electromotive systems included a rigid coupling between a stator and a shaft support system. This generated a "tuning fork" effect when the resonant frequency of the system falls in the range of the unavoidable high frequency torque vibrations. Such torque variations or vibrations are particularly unavoidable with electric motors and which have sufficient amplitude to lead to the disturbing noises, especially when the pump is operated with a full load.

In accordance with one aspect of the present invention, the rigid coupling between the stator and the shaft support is eliminated with respect to torque transmission. The transmission of the torque moment occurs essentially via the coupling of the stator with the remaining housing through an intermediary base plate and not through the shaft support. The shaft support serves for positioning the stator in the plane which extends transversely in relation to the shaft support.

An improved suppression of the disturbing noises is obtained by providing

a gap between the interior wall of the stator and the outer wall of the shaft support. Vibration-absorbing elements are preferably included in the system to maintain the gap and include, for example, O-rings. Also, the gap can be filled at least partially with a viscous medium. The O-rings, however, do not transmit torque between the stator and the shaft support.

In the preferred embodiment of the invention as described in the specification, the torque transmission from the stator to the remaining housing takes place via a supporting base plate. The base plate preferably includes a punched-out grid. The stator is mounted directly onto the supporting base plate. The base plate is in turn mounted to the motor housing. The support shaft extends from the motor housing and rotatably supports the motor output shaft therein.

More specifically and with reference to the drawing figures of the application, in order to avoid noises which develop with prior art drives in use heretofore, the stator 7 is not joined directly to the shaft support 15. Rather, the shaft support 15 and the stator 7 are arranged such that a gap exists between an inner wall of the stator 7 and an outer wall of the shaft support 15. Preferably, one or more O-rings 12 are disposed in grooves 12a on the outer wall of the shaft support 15. The O-rings 12 preferably have flexibility and produce a dampening effect, thus acting as vibration-dampening elements between the stator and the shaft support 15. A viscous medium such as a grease or the like can be disposed in the gap between the stator and the shaft. It is to be appreciated that a substantially rigid coupling between the stator 7 and the shaft support 15 is avoided. Such a rigid coupling would support tangential power transmission or the transmission of torque from the stator 7 to the shaft support 15. This is undesirable and avoided in the present application.

Japanese Patent JP 5-199,721:

Japanese Patent JP 5-199,721 to Takahashi teaches a motor adapted to suppress an phenomena of a vibrating printed circuit board fixed with a stator of a brushless DC motor in an axial direction caused by mutual operation by magnetic attraction and repulsion between a stator core and a rotor magnet. As shown in the drawing figure of the Takahashi '721 patent, a stator core 10 of a brushless DC motor is fixed to a printed circuit board 13. An outer periphery of the board 13 is clamped with an upper surface 6a of a housing using screws. The surface 6a of the housing is

formed at its inner periphery higher than its outer periphery. Thus, mounting rigidity of the board 13 is enhanced and an axial vibration is suppressed to reduce noise. Thus, the deterioration of rotating performance of the motor can be prevented by contact of the rotor surface of the printed circuit board 13 with the upper surface 6a of the housing.

It is to be appreciated that in Takahashi '721, the entire bottom surface of the printed circuit board 13 is in contact with the upper surface 6a of the housing to suppress axial vibration of the housing. Also, the board is rigidly held against the housing. The stator is carried on the board and, therefore, is effectively rigidly coupled to the housing through the rigid board connection.

U.S. Patent No. 5,006,765 to Schmider:

U.S. Patent No. 5,006,765 to Schmider describes a DC motor with a coreless coil installation. More particularly, a stator coil 8 is provided in the motor. However, the stator coil 8 is not mounted to the housing by means of a shaft support which transverses the stator.

In the Action, the Examiner took the position that Schmider teaches an extrusion-coated punched-out grid to support a stator inside a motor to provide a cost effective and reliable electrical connection to the motor. However, because of the physical construction to the motor taught in the Schmider '765 patent, the stator coil 8 is separated from the shaft support 11 by a fairly large distance and, accordingly, vibration in the stator and shaft support components are not of particular concern. Essentially, vibrations in the shaft support and stator are not even mentioned in the Schmider '765 patent.

In addition to the above, it is respectfully submitted that the shaft support 11 taught in the Schmider '765 patent does not truly traverse the stator coil 8.

Independent Claim 1 is in Condition for Allowance:

It is respectfully submitted that independent claim 1 is patentably distinct and unobvious over the references of record. More particularly, as noted by the Examiner, the Takahashi '721 teaching does not include a showing of an extrusion-coated punched-out grid to dampen torque vibrations. Independent claim 1 includes the limitation of the base plate including an extrusion-coated punched-out grid. In addition, the Examiner has noted that the Schmider '765 patent shows an extrusion-

coated punched-out grid that would reduce high frequency torque vibrations if substituted into the circuit board construction taught in the Takahashi '721 patent. However, applicant respectfully submits that if the punched-out grid taught in the Schmider '765 patent were put into the position and arranged as shown in the Takahashi '721 patent, no torque vibrations would be dampened at all. More particularly, as can be seen in Figures 1-3 of the Takahashi '721 patent, the circuit board is held at an angle (Figure 1), on a step (Figure 2), or in a pinned (Figure 3) configuration to "pre-stress" the circuit board so that it is held fixed relative to the housing bottom. It is therefore unclear to applicant how the mere substitution of a punched-out grid of the type alluded to in the Schmider '765 patent could be used in the construction taught in the Takahashi '721 patent to relieve or otherwise eliminate high frequency vibrations. The Takahashi construction does not permit the board to flex.

Applicant respectfully submits that independent claim 1 is directed to a novel electromotive drive including a housing, a stator, and a base plate including an extrusion-coated punched-out grid fastened to the housing whereby transmission of a torque moment from the stator to the housing occurs via the base plate and whereby high frequency vibrations of transmitted torque are dampened by the punched-out grid.

Applicant respectfully submits that the combination suggested by the Examiner is not suggested in the art and, further, is not proper. In addition, even if the combination were made, it would not exhibit the high frequency vibration suppression/dampening as required in independent claim 1. For at least the above reasons, applicant respectfully submits that independent claim 1 is patentably distinct and unobvious over the references of record.

Independent Claim 11 is in Condition for Allowance:

As noted above, it is respectfully submitted that each of the primary art references alone do not teach, suggest, or fairly disclose the subject matter recited in independent claim 11. In addition, it is respectfully submitted that the art is not combinable in a manner suggested by the Examiner. Further, even if the art were combined in the manner suggested by the Examiner, the resultant construction would not result in a dampening of high frequency vibrations of torque transmission through a punched-out grid.

Turning now to independent claim 11, an electromotive drive is recited

comprising a housing having a shaft support, a base plate comprising an extrusion-coated punched-out grid, a stator surrounding the shaft support and attached to the base plate whereby high frequency vibrations of the torque transmission are dampened by the punched-out grid, a shaft rotatably arranged within the shaft support, and a rotor attached to the shaft and surrounding the stator.

Independent claim 11 includes the limitation of the stator attached to the base plate comprising an extrusion-coated punched-out grid whereby high frequency vibrations of the torque transmission are dampened by the punched-out grid.

Again, it is respectfully submitted that if a construction were completed in a manner suggested by the Examiner, namely substituting the grid of the Schmider '765 patent into the Takahashi '721 constructions, high frequency vibrations of torque transmission would not be dampened by the punched-out grid. This is a clear limitation contained in independent claim 11.

For at least the above reasons, it is respectfully submitted that independent claim 11 is patentably distinct and unobvious over the reference of record.

TELEPHONIC INTERVIEW

Applicant respectfully requests that the Examiner contact applicant's representative to conduct a telephonic interview at the convenience of the Examiner in order to best help facilitate prosecution of the instant application.

If all is in proper order, however, a Notice of Allowance is respectfully requested.

CONCLUSION

In view of the above amendments, comments, and arguments presented, applicant respectfully submits that all pending claims are patentably distinct and unobvious over the references of record.

Allowance of all claims and early notice to that effect is respectfully requested.

Respectfully submitted,

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